Exhibit B

**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION**

GESTURE TECHNOLOGY PARTNERS, LLC, Plaintiff v. HUAWEI DEVICE CO., LTD., HUAWEI DEVICE USA, INC. Defendants.	JURY TRIAL DEMANDED Case No. 2:21-cv-00040-JRG (Lead Case)
GESTURE TECHNOLOGY PARTNERS, LLC, Plaintiff v. SAMSUNG ELECTRONICS CO., LTD. AND SAMSUNG ELECTRONICS AMERICA, INC., Defendants.	JURY TRIAL DEMANDED Case No. 2:21-cv-00041-JRG (Member Case)

DEFENDANTS' INVALIDITY AND SUBJECT-MATTER ELIGIBILITY CONTENTIONS

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

Page

TABLE OF CONTENTS
(continued)

Page

TABLE OF CONTENTS
(continued)

Page

TABLE OF CONTENTS
(continued)

Page

TABLE OF CONTENTS
(continued)

Page

Defendants Huawei Device Co., Ltd., Huawei Device USA, Inc. (together, "Huawei") and Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (together, "Samsung") (collectively, "Defendants") provide these Invalidity and Subject-Matter Eligibility Contentions concerning U.S. Patent Nos. 7,933,431 ("'431 Patent"), 8,194,924 ("'924 Patent), 8,553,079 ("'079 Patent"), and 8,878,949 ("'949 Patent") (collectively, "Asserted Patents") pursuant to the Court's Docket Control Order (Dkt. No. 44), Local Patent Rule ("P.R.") 3-3, and the Court's Standing Order Regarding Subject-Matter Eligibility Contentions.

Defendants' Invalidity and Subject-Matter Eligibility Contentions reflect Defendants' knowledge as of this early date in the present action. Defendants reserve the right, to the extent permitted by the Court and the applicable statutes and rules, to modify and/or supplement their Invalidity and Subject-Matter Eligibility Contentions in response to becoming aware of additional prior art or other information regarding invalidity, additional information regarding subject-matter eligibility, any modification or supplementation of Plaintiff's Infringement Contentions, any claim construction by the Court, or as otherwise may be appropriate.

The Docket Control Order, Patent Rules, and Standing Order Regarding Subject-Matter Eligibility Contentions contemplate these Invalidity and Subject-Matter Eligibility Contentions being prepared and served in response to Plaintiff's Infringement Contentions and the allegations therein regarding Plaintiff's theory of infringement with respect to each Accused Instrumentality. Plaintiff's Infringement Contentions, however, are fundamentally deficient because they fail to provide full, fair, and timely disclosure as to how Defendants allegedly infringe each element of each asserted claim of the Asserted Patents ("Asserted Claims"). Accordingly, Defendants reserve the right to seek leave to amend these Invalidity and Subject-Matter Eligibility Contentions as may be appropriate. Defendants also reserve the right to seek leave to amend in light of positions that

US	6,335,985	Filing Date: Dec. 30, 1998 Issue Date: Jan. 1, 2002	Sambonsugi
US	6,401,085	Filing Date: Mar. 5, 1999 Issue Date: Jun. 4, 2002	Gershman
US	6,393,136	Filing Date: Jan. 4, 1999 Issue Date: May 21, 2002	Amir
US	5,900,863	Filing Date: Mar. 13, 1996 Issue Date: May 4, 1999	Numazaki '863
US	5,454,043	Filing Date: Jul. 30, 1993 Issue Date: Sept. 26, 1995	Freeman
US	6,002,808	Filing Date: Jul. 26, 1996 Issue Date: Dec. 14, 1999	Freeman '808
JPH	7175587	Filing Date: Jul. 5, 1994 Publication Date: Jul. 14, 1995	Aria '587
US	5,724,062	Filing Date: Sept. 21, 1994 Issue Date: Mar. 3, 1998	Hunter
US	6,160,899	Filing Date: Jul. 21, 1998 Issue Date: Dec. 12, 2000	Lee
US	5,227,985	Filing Date: Aug. 19, 1991 Issue Date: Jul. 13, 1993	DeMenthon
US	6,353,428	Filing Date: Feb. 10, 1998 Issue Date: Mar. 5, 2002	Maggioni
US	6,181,343	Filing Date: Dec. 23, 1997 Issue Date: Jan. 30, 2001	Lyons '343
US	2003-0189658	Filing Date: Apr. 11, 2003 Issue Date: Oct. 9, 2003	Morris
JPH	0736610	Filing Date: Jun. 28, 1993 Publication Date: Feb. 7, 1995	Kishi
US	6,573,939	Filing Date: Mar. 2, 1998 Issue Date: Jun. 3, 2003	Yokoyama
US	6,373,507	Filing Date: Sept. 14, 1998 Issue Date: Apr. 16, 2002	Camara
US	6,351,222	Filing Date: Oct. 30, 1998 Issue Date: Feb. 26, 2002	Swan
US	6,262,767	Filing Date: Jun. 18, 1997 Issue Date: Jul. 17, 2001	Wakui
US	5,594,469	Filing Date: Feb. 21, 1995 Issue Date: Jan. 14, 1997	Freeman '469
JPH	473631	Filing Date: Jul. 13, 1990 Publication Date: Mar. 9, 1992	Osamu Nonaka
US	6,580,448	Filing Date: May 13, 1996 Issue Date: Jan. 17, 2003	Stuttler
US	5,748,326	Filing Date: Dec. 2, 1994 Issue Date: May 5, 1998	Thompson-Bell

B. Prior Art Publications

Defendants contend the following prior art publications anticipate or render obvious one or more Asserted Claims of the Asserted Patents under 35 U.S.C. § 102(a) and/or (b) or 35 U.S.C. § 103. Pursuant to P.R. 3-3(c), Defendants attach claim charts as Exhibits A1-A3, B1-B3, C1-C3, and D1-D3, identifying examples of where, in certain items of prior art listed in the Table below, the elements of each Asserted Claim of the Asserted Patents are found.[6]

Publication Title	Date	Publisher	Author(s)
Toward Multimodal Human-Computer Interface	May 5, 1998	IEEE	Sharma et al.
Visual Interpretation of Hand Gestures for Human-Computer Interaction: A Review	July 7, 1997	IEEE Transactions on Pattern Analysis and Machine Interface Intelligence	Pavlovic et al.
Speech/gesture interface to a visual computing environment for molecular biologists	Aug. 1996	Proc. Int. Conf. Pattern Recognition	Sharma et al.
Speech/Gesture Interface to a Visual-Computing Environment	Apr. 2000	IEEE Computer Graphics and Applications	Sharma et al.
Prototype Speech Recognition Interface for VMD	Pre-1998	Beckman Institute, University of Illinois at Urbana-Chmpaign	Phillips et al.
Molecular Dynamics Studies of the Protein Bacteriorhodopsin	Sept. 1996	University of Illinois at Urbana-Champaign	Humphrey, William F.

[6] The claim chart titled "MERL" and "MDScope" incorporate the above prior art.

Publication Title	Date	Publisher	Author(s)
Simplified Expression of Message-Driven Programs and Quantification of Their Impact on Performance	Apr. 1994	University of Illinois at Urbana-Champaign	Attila, Gursoy
Dynamic Bayesian Networks for Information Fusion with Applications to Human-Computer Interfaces	Nov. 1998	University of Illinois at Urbana-Champaign	Pavlovic, Valdimir
A Visual Computing Environment for Very Large Scale Biomolecular Modeling	1997	IEEE	Zeller et al.
Video Clip of MERL	Pre-1998	Mitsbubishi Electric Research Laboratires	Freeman et al.
MDScope - A Visual Computing Environment for Structural Biology	January 6, 1995	*Comput. Phys. Commun.*, vol. 91, no. 1/2/3, pp. 111–134, 1995.	Nelson et al.
Computer Vision for Interactive Computer Graphics	May/June 1998	Computer Graphics I/O Devices	Freeman et al.
Orientation Histograms for Hand Gesture Recognition, TR94-03	December 1994	IEEE International Workshop on Automatic Face and Gesture Recognition; Mitsubishi Electric Research Laboratories, Inc.	Freeman et al.
Television Control by Hand Gestures, TR94-24	December 1994	IEEE International Workshop on Automatic Face and Gesture Recognition; Mitsubishi Electric Research Laboratories, Inc.	Freeman et al.

Deleted: ,

Publication Title	Date	Publisher	Author(s)
Computer Vision for Computer Games	October 1996	IEEE International Workshop on Automatic Face and Gesture Recognition; Mitsubishi Electric Research Laboratories, Inc.	Freeman et al.
Face and Hand Gesture Recognition Using Hybrid Classifiers	October 1996	Proceedings of the Second International Conference on Automatic Face and Gesture Recognition	Wechsler et al.
Face Location Using a Dynamic Model of Retinal Feature Extraction	June 26-28, 1995	International Workshop on Automatic Face and gesture Recognition	Wechsler et al.
Automatic Video-Based Person Authentication Using the RBF Network	1997	AVBPA 1997. Lecture Notes in Computer Science, vol 1206. Springer, Berlin, Heidelberg	Wechsler et al.
A Kinetic and 3D Image Input Device	April 18, 1998	CHI 98 ACM ISBN 1-58113-028-7	Numazaki et al.
Situated Information Spaces and Spatially Aware Palmtop Computers	July 1993	Communications of the ACM	Fitzmaurice
HMDs, Caves & Chameleon: A Human-Centric Analysis of Interaction in Virtual Space	November 1998	Computer Graphics	Fitzmaurice et al.
Unencumbered Gestural Interaction	Winter 1996	IEEE Multimedia	Quek
Pfinder: Real-Time Tracking of the Human Body	July 7, 1997	IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 19, NO. 7,	Pentland et al.

C. Prior Art Uses/Sales/Offers for Sale

Defendants contend the following prior art uses, sales, and/or offers for sale anticipate or render obvious one or more Asserted Claims of the Asserted Patents under 35 U.S.C. § 102(a) and/or (b) or 35 U.S.C. §103.[7] Pursuant to P.R. 3-3(c), Defendants attach claim charts as Exhibits A1-A3, B1-B3, C1-C3, and D1-D3, identifying examples of where, in certain items of prior art listed in the Table below, the elements of each Asserted Claim of the Asserted Patents are found.[8]

Item	Date	Identity of Entities/Persons
TV Controller Using Hand Gestures and Related Interactive Computer Graphics Applications ("MERL")	1994-1998	Mitsubishi Electronics Research Laboratories ("MERL")
3D Image Control with Hand Gestures, including Control of Molecular Biology Modeling ("MDScope")	May 1998	University of Illinois at Urbana-Champaign
Nintendo Gameboy	1997	Nintendo
Motorola STAR TAC	1997	Motorola
Fujifilm DS-7	1996	Fuji
Casio QV-30	1996	Casio
Nokia 5160	1998	Nokia
Vision Based Authentication, Vehicle Control and Face/Gesture Recognition	1996-1998	George Mason University
Sign Language Recognition Systems	~ 1996	Sign Language Reference
A Kinetic and 3D Image Input Device	1998	Toshiba
Chameleon Prototype	1993-1998	Possibly Apple and Silicon Graphics

[7] The Nintendo Gameboy, Motorola STAR TAC, Fujifilm DS-7, and Nokia 5160 are available for inspection.
[8] The claim chart titled "Handheld Devices" incorporates disclosures relating to the Nintendo Gameboy, Motorola STAR Tac, Fujifilm DS-7, and the Nokia 5160. The claim chart titled "MERL" and "MDScope" incorporate explicitly or inherently the other systems identified by Defendants in Section III.C.

Item	Date	Identity of Entities/Persons
Wearable Home Automation and Medial Monitoring Device	1999	Georgia Institute of Technology
Cosm Communicator	1998	Sony
FingerMouse	1996	University of Illinois at Chicago
Media Smart Room/Pfinder	1980-1998	Massachusetts Institute of Technology

Defendants further intend to seek discovery regarding the above-mentioned prior art systems, in addition to other systems, that may be related to the Asserted Patents and printed publication references disclosed in these contentions. Defendants will supplement these contentions to incorporate such discovery, as necessary.

D. <u>Prior Art under 35 U.S.C. § 102(f)</u>

Defendants contend that the following prior art invalidates one or more Asserted Claims of the Asserted Patents under pre-AIA 35 U.S.C. § 102(f).[9]

Prior Art	Date Publicly Available	Name of the Person from Whom the Invention or Any Part of it was Derived	Circumstances under which the invention or any part of it was derived
U.S. Appl. No. 08/203,603	February 28, 1994	Peter Harmon Smith	sole inventor or co-inventor
U.S. Appl. No. 08/290,516	August 15, 1994	Peter Harmon Smith	sole inventor or co-inventor
U.S. Appl. No. 08/435,854	May 5, 1995	Peter Harmon Smith	sole inventor or co-inventor
U.S. Appl. No. 08/468,358	June 6, 1995	Peter Harmon Smith	sole inventor or co-inventor
U.S. Appl. No. 08/469,429	June 6, 1995	Peter Harmon Smith	sole inventor or co-inventor

[9] Defendants contend that Peter Harmon Smith is an omitted inventor from the Asserted Patents. The patent applications listed in the Section III.D were incorporated by reference by Pryor during the prosecution history of the patent applications that issued as the Asserted Patents. Defendants could not locate public copies of U.S. Provisional Application No. 60/031,256 and U.S. Application Nos. 08,968,114, 08/466,294, 08/470,325, 08/469,429, and 09/568,554.

Defendants identify apparatus Claim 11 of the ’079 Patent as representative of Claims 1 through 6, 8, 9, 13 through 15, 19, 21 through 26, 28, 30. GTP called out claim 11 as representative in its Complaint. Dependent Claims 13, 14, 15, and 19 only provide further specificity on the well-known, conventional components that appear in Claims 11 or recite known operations that could have been performed on those components. Method claims 1 and 21 appear to be an attempt to cast the representative system of Claim 11 as method claims. Dependent Claims 2 through 6, 8, 9, 22 through 26, 28 and 30. Only provide further specificity on the well-known, conventional steps that appear in Claims 1 and 21.

DATED: July 6, 2021

By: */s/ Christopher W. Kennerly*

Christopher W. Kennerly (TX Bar No. 00795077)
chriskennerly@paulhastings.com
Radhesh Devendran (*pro hac vice*)
radheshdevendran@paulhastings.com
PAUL HASTINGS LLP
1117 S. California Avenue
Palo Alto, CA 94304
Telephone: (650) 320-1800
Facsimile: (650) 320-1900

Allan M. Soobert
allansoobert@paulhastings.com
PAUL HASTINGS LLP
2050 M Street NW
Washington, D.C. 20036
Telephone: 202-551-1700
Facsimile: 202-551-1705

Elizabeth L. Brann
elizabethbrann@paulhastings.com
PAUL HASTINGS LLP
4747 Executive Drive, 12th Floor
San Diego, CA 92121
Telephone: (858) 458-3000
Facsimile: (858) 458-3005

Robert Laurenzi
robertlaurenzi@paulhastings.com
PAUL HASTINGS LLP
200 Park Avenue
New York, NY 10166
Telephone: (212) 318-6000
Facsimile: (212) 319-4090

Melissa R. Smith (TX Bar No. 24001351)
GILLAM & SMITH, LLP
303 S. Washington Ave.
Marshall, TX 75670
Telephone: (903) 934-8450
Facsimile: (903) 934-9257
melissa@gillamsmithlaw.com

Attorneys for Defendants Samsung Electronics Co., Ltd and Samsung Electronics America, Inc.

/s/ *Kent E. Baldauf, Jr.*
Kent E. Baldauf, Jr. (PA ID No. 70793)
Bryan P. Clark (PA ID No. 205708)
THE WEBB LAW FIRM
One Gateway Center
420 Ft. Duquesne Blvd., Suite 1200
Pittsburgh, PA 15222
412.471.8815
412.471.4094 (fax)
kbaldaufjr@webblaw.com
bclark@webblaw.com

AND

J. Mark Mann (TX ID No. 12926150)
G. Blake Thompson (TX ID No. 24042033)
MANN TINDEL & THOMPSON
201 E. Howard Street
903.657.8540
903.657.6003 (fax)
mark@themannfirm.com
blake@themannfirm.com

Attorneys for Defendants Huawei Device Co., Ltd. and Huawei Device USA, Inc.

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing document has been served via email on all counsel of record on this 6th day of July, 2021.

/s/ Christopher W. Kennerly
Christopher W. Kennerly

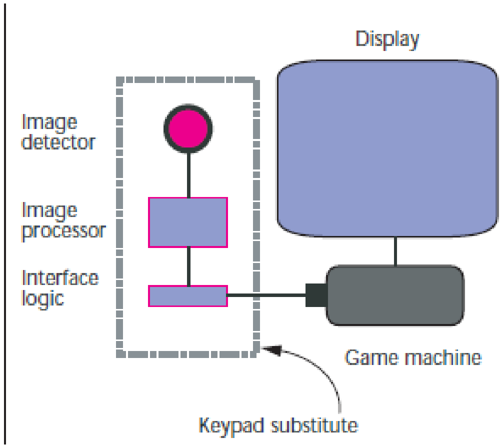
NOTE: Defendants apply the prior art in light Defendants' current understanding of the asserted claims and Plaintiff's apparent construction of those claims, as reflected in its Infringement Contentions and claim construction disclosures. Defendants' prior art invalidity contentions may reflect alternative positions as to claim construction and scope and do not represent any admissions or agreement by Defendants as to the construction meaning, scope, definiteness, function, structure, written description support for, or enablement of any claim contained herein. Defendants' contentions herein are not, and should in no way be seen as, any admission that Defendants' accused technology meets any limitations of the claims.

Exhibit A2

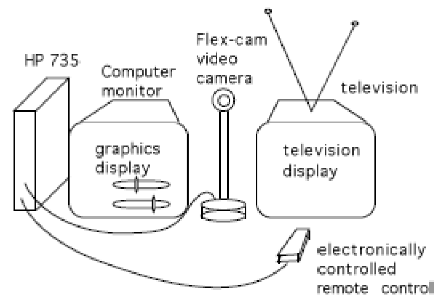
Mitsubishi Electric Research Laboratory TV, Toy, Crane, and Game Control Systems ("MERL")
vs.
Claims of Asserted U.S. Patent No. 8,194,924 ("'924 Patent")

Formatted: Space After: 0 pt

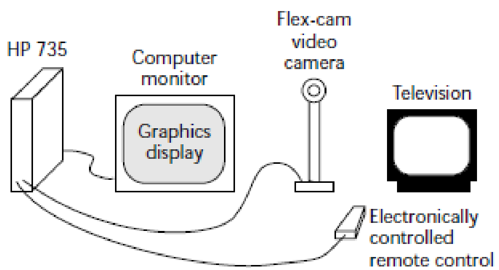
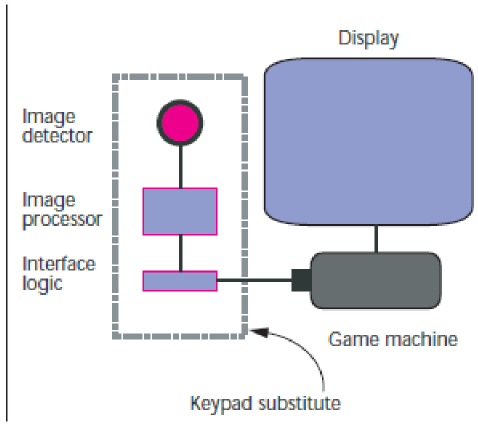
'924 Patent/Claim	MERL
'924 Patent	
[1.Preamble] A handheld device comprising:	To the extent the preamble is construed as limiting, MERL discloses "[a] handheld device comprising:" • We applied several different vision algorithms in interactive computer games. As shown in Figure 2, we replaced the hand-held game keypad with a detector, a processor, and interface hardware. The interface hardware, controlled by the processor interpreting detector images, issues commands that look like keypad commands to the Sega Saturn game machine. Computer Vision for Interactive Computer Graphics, p. 44.

<table>
<tr><th>’924 Patent/Claim</th><th>MERL</th></tr>
<tr><td></td><td>

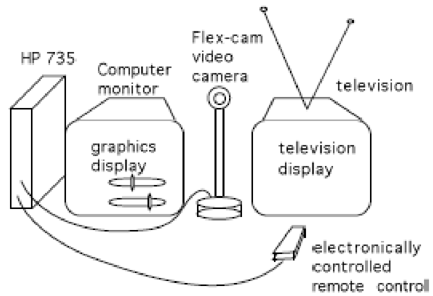
Computer Vision for Interactive Computer Graphics, Fig. 2.</td></tr>
</table>

’924 Patent/Claim	MERL
	 **Figure 9:** Hardware components for prototype. A Flex-cam video camera produces a video image, which is digitized by a RasterOps video digitizer card in the HP-735 workstation. The computer analyzes the image and displays the appropriate graphics on the computer display screen. The user moves his hand to adjust the on-screen controls. The computer then issues the appropriate commands over a serial port to an electronically controllable remote control. While this prototype uses two display screens, future versions could display the graphics overlay directly on the television screen. Television Control by Hand Gestures. Fig. 7 on p. 7. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[1.A]: a housing;	MERL discloses “a housing[.]”

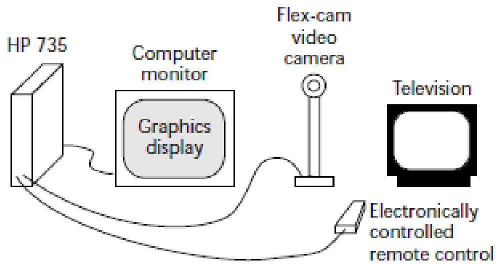
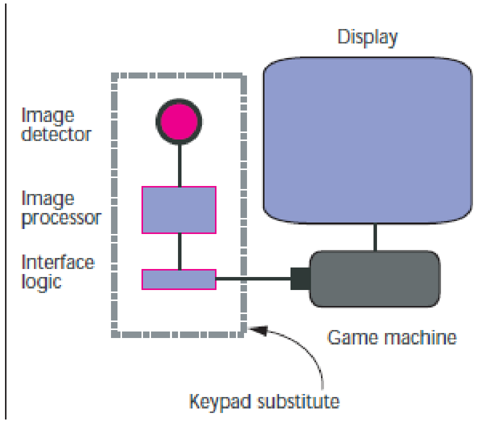
’924 Patent/Claim	MERL
	See supra 1.Preamble. *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[1.B]: a computer within the housing;	MERL discloses “a computer within the housing[.]” • Vision can be a powerful interface device for computers because of its potential for sensing body position, head orientation, direction of gaze, pointing commands, and gestures. Computer Vision for Interactive Computer Graphics, p. 42. • In some interactive applications the computer needs to track the position or orientation of a body or hand that is prominent in the camera’s visual field. Computer Vision for Interactive Computer Graphics, p. 42. • Artificial Retina Chip We developed an image detector that allows programmable on-chip processing. By analogy with the fast, low-level processing that occurs in the eye, we call the detector the *artificial retina* (AR) chip. Computer Vision for Interactive Computer Graphics, p. 44. • We applied several different vision algorithms in interactive computer games. As shown in Figure 2, we replaced the hand-held game keypad with a detector, a processor, and interface hardware. The interface hardware, controlled by the processor interpreting detector images, issues commands that look like keypad commands to the Sega Saturn game machine.

’924 Patent/Claim	MERL
	Computer Vision for Interactive Computer Graphics, p. 44.  Computer Vision for Interactive Computer Graphics, Fig. 11.  Computer Vision for Interactive Computer Graphics, Fig. 2.

’924 Patent/Claim	MERL
	• The open hand presents a characteristic image which the computer can detect and track. We per-form a normalized correlation of a template hand to the image to analyze the user's hand. A local orientation representation is used to achieve some robustness to lighting variations. Television Control by Hand Gestures. p. 3 of 7 [pdf]. • We made a prototype of this system using a computer workstation and a television. The graphical overlays appear on the computer screen, although they could be mixed with the video to appear on the television. The computer controls the television set through serial port commands to an electronically controlled remote control. We describe knowledge we gained from building the prototype. Television Control by Hand Gestures. p. 3 of 7 [pdf]. • All image processing was performed in the workstation, on software written in C and C++. Television Control by Hand Gestures. p. 5 of 7 [pdf].

’924 Patent/Claim	MERL
	 Figure 9: Hardware components for prototype. A Flex-cam video camera produces a video image, which is digitized by a RasterOps video digitizer card in the HP-735 workstation. The computer analyzes the image and displays the appropriate graphics on the computer display screen. The user moves his hand to adjust the on-screen controls. The computer then issues the appropriate commands over a serial port to an electronically controllable remote control. While this prototype uses two display screens, future versions could display the graphics overlay directly on the television screen. Television Control by Hand Gestures. Fig. 7 on p. 7 of 7 [pdf]. • All image processing was performed in the workstation, on software written in C and C++. Television Control by Hand Gestures. p. 7 of 7 [pdf]. • We have developed an image detector which allows programmable on-chip processing. By analogy with the fast, low-level processing that occurs in the eye, we call the detector the articial retina (AR) chip [10]. Figure 1 shows the elements of the AR chip: a 2-D array of variable sensitivity photo detection cells (VSPC), a random access scanner for sensitivity control, and an output

’924 Patent/Claim	MERL
	multiplexer [7]. The VSPC consists of a pn photo-diode and a deferential amplifier which allows for high detection sensitivity of either positive or negative polarity. This structure also realizes nondestructive readout of the image, essential for the image processing. The detector arrays can range in resolution from 32x32 to 256 x 256 pixels; for this paper we assume a 32x32 detector array. Computer Vision for Computer Games, p. 3 of 8 [pdf]. • We have integrated this detector/processor chip into an inexpensive AR module, which contains a low-resolution (32x32) A. R. detector chip, support and interface electronics, and a 16 bit 1MHz micro- processor. The module is 8 x 4 x 3 cm and is inexpensive enough to cost only several tens of dollars. Computer Vision for Computer Games, p. 3 of 8 [pdf]. • The computer stores the orientation histograms corresponding to each image. Orientation Histograms for Hand Gesture Recognition, p. 6 of 9 [pdf]. *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[1.C] a first camera oriented to view a user of the handheld device and having a first camera output; and	MERL discloses “a first camera oriented to view a user of the handheld device and having a first camera output[.]” • In some interactive applications the computer needs to track the position or orientation of a body or hand that is prominent in the camera’s visual field. Relevant.

’924 Patent/Claim	MERL
	Computer Vision for Interactive Computer Graphics, p. 42.  Computer Vision for Interactive Computer Graphics, Fig. 11.  Computer Vision for Interactive Computer Graphics, Fig. 2.

’924 Patent/Claim	MERL
	• If the camera views a hand on a uniform background, this method can distinguish hand positions and simple pointing gestures, as shown in Figure 1a. . . The robot followed the direction in which the hand was pointing; tilting the hand perpendicular to the camera caused the robot to stop. Computer Vision for Interactive Computer Graphics, p. 43. • We had a user position his hand close to the camera so that his hand became a large object in the camera’s field of view. Computer Vision for Interactive Computer Graphics, p. 44. • We want gestures to be the same regardless of where they occur within the camera’s field of view. Computer Vision for Interactive Computer Graphics, p. 46. • The previous algorithms involved tracking or characterizing objects that appear large in the camera frame. Many interactive applications also require tracking objects, such as the user’s hand, that comprise only a small part of the image. Here we describe one such application and our system solution. Computer Vision for Interactive Computer Graphics, p. 49. • To increase the processing speed, we restricted the field of view of the television’s camera to 15 degrees when initially searching for the hand, and 25 degrees in tracking mode. Computer Vision for Interactive Computer Graphics, p. 51. • Our solution to these problems exploits the visual feedback of the television display. The user uses only one gesture: the open hand, facing the camera. Television Control by Hand Gestures, p. 3 of 7 [pdf].

<table>
<tr><th>’924 Patent/Claim</th><th>MERL</th></tr>
<tr><td></td><td>

- Figure 2 shows a view from a camera near a living room television set.

Television Control by Hand Gestures, p. 3 of 7 [pdf].

Figure 2: A typical visual scene which a camera looking out from a television set might encounter. It is complicated, unpredictable, and the hand is not a dominant part of the image.

Television Control by Hand Gestures, Fig. 2 on p. 4 of 7 [pdf].

- A Flex-Cam video camera acquired NTSC format television images. These were digitized at 640 x 480 resolution and downsampled by a factor of 2 by a Raster Ops VideoLive card in an HP 735 workstation.

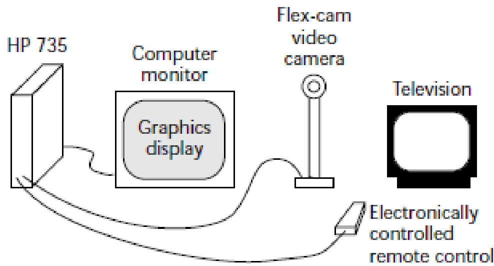
Television Control by Hand Gestures, p. 5 of 7 [pdf].

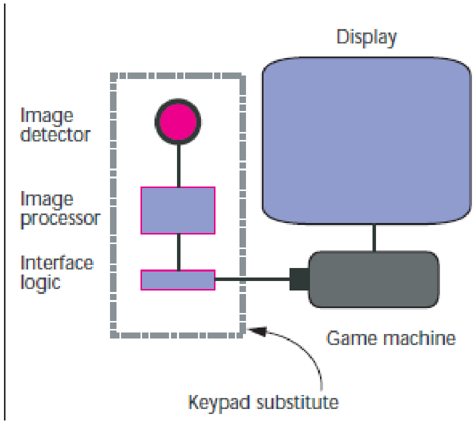
- The image processing of the artificial retina can be expressed as a matrix equation. In Fig. 1, the input image projected onto the chip is the weight matrix W. All VSPC's have three electrodes. A direction sensitivity electrode, connected along rows, yields the sensitivity control vector, S. The

</td></tr>
</table>

'924 Patent/Claim	MERL
	VSPC sensitivities can be set to one of (+1; 0;1) at each row. An output electrode is connected along columns, yielding an output photocurrent which is the vector product, J = WS. The third electrode is used to reset the accumulated photo-carriers. This hardware can sense the raw image and execute simple linear operations such as local derivatives and image projections. Computer Vision for Computer Games, p. 3 of 8 [pdf]. *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants' invalidity contentions.
[1.D] a second camera oriented to view an object other than the user of the device and having a second camera output, wherein the first and second cameras include non-overlapping fields of view, and wherein the computer is adapted to perform a control function of the handheld device based on at least one of the first camera output and the second camera output.	MERL discloses "a second camera oriented to view an object other than the user of the device and having a second camera output, wherein the first and second cameras include non-overlapping fields of view, and wherein the computer is adapted to perform a control function of the handheld device based on at least one of the first camera output and the second camera output." To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants' invalidity contentions.
[2] The handheld device of claim 1 wherein the handheld	MERL discloses "[t]he handheld device of claim 1 wherein the handheld device comprises a mobile phone."

Deleted: ¶
¶
¶

’924 Patent/Claim	MERL
device comprises a mobile phone.	To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[3] The handheld device of claim 1 wherein the first camera is adapted to acquire an image of at least a portion of the user.	MERL discloses “[t]he handheld device of claim 1 wherein the first camera is adapted to acquire an image of at least a portion of the user.” • In some interactive applications the computer needs to track the position or orientation of a body or hand that is prominent in the camera’s visual field. Relevant. Computer Vision for Interactive Computer Graphics, p. 42.  Computer Vision for Interactive Computer Graphics, Fig. 11.

’924 Patent/Claim	MERL
	 Computer Vision for Interactive Computer Graphics, Fig. 2. • If the camera views a hand on a uniform background, this method can distinguish hand positions and simple pointing gestures, as shown in Figure 1a. . . The robot followed the direction in which the hand was pointing; tilting the hand perpendicular to the camera caused the robot to stop. Computer Vision for Interactive Computer Graphics, p. 43. • We had a user position his hand close to the camera so that his hand became a large object in the camera’s field of view. Computer Vision for Interactive Computer Graphics, p. 44. • We want gestures to be the same regardless of where they occur within the camera’s field of view. Computer Vision for Interactive Computer Graphics, p. 46.

<table>
<tr><th>’924 Patent/Claim</th><th>MERL</th></tr>
<tr><td></td><td>
The previous algorithms involved tracking or characterizing objects that appear large in the camera frame. Many interactive applications also require tracking objects, such as the user’s hand, that comprise only a small part of the image. Here we describe one such application and our system solution.
Computer Vision for Interactive Computer Graphics, p. 49.
To increase the processing speed, we restricted the field of view of the television’s camera to 15 degrees when initially searching for the hand, and 25 degrees in tracking mode.
Computer Vision for Interactive Computer Graphics, p. 51.
Our solution to these problems exploits the visual feedback of the television display. The user uses only one gesture: the open hand, facing the camera.
Television Control by Hand Gestures, p. 3 of 7 [pdf].
Figure 2 shows a view from a camera near a living room television set.
Television Control by Hand Gestures, p. 3 of 7 [pdf].
</td></tr>
</table>

<table>
<tr><th>’924 Patent/Claim</th><th>MERL</th></tr>
<tr><td></td><td>


Figure 2: A typical visual scene which a camera looking out from a television set might encounter. It is complicated, unpredictable, and the hand is not a dominant part of the image.

Television Control by Hand Gestures, Fig. 2 on p. 4 of 7 [pdf].

• A Flex-Cam video camera acquired NTSC format television images. These were digitized at 640 x 480 resolution and downsampled by a factor of 2 by a Raster Ops VideoLive card in an HP 735 workstation.

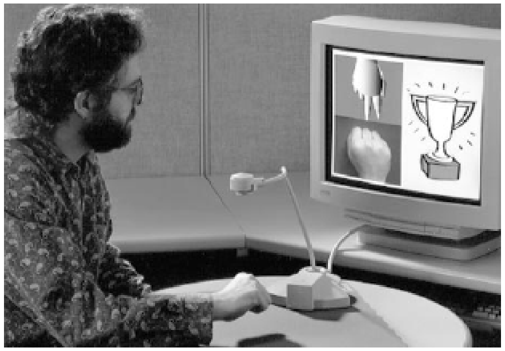
Television Control by Hand Gestures, p. 5 of 7 [pdf].

• The image processing of the artificial retina can be expressed as a matrix equation. In Fig. 1, the input image projected onto the chip is the weight matrix W. All VSPC's have three electrodes. A direction sensitivity electrode, connected along rows, yields the sensitivity control vector, S. The VSPC sensitivities can be set to one of (+1; 0;1) at each row. An output electrode is connected along columns, yielding an output photocurrent which is the vector product, J = WS. The third electrode is used to reset the accumulated photo-carriers. This hardware can sense the raw image and execute simple linear operations such as local derivatives and image projections.
</td></tr>
</table>

’924 Patent/Claim	MERL
	Computer Vision for Computer Games, p. 3 of 8 [pdf]. *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[4] The handheld device of claim 1 wherein the second camera is adapted to acquire an image of the object.	MERL discloses “[t]he handheld device of claim 1 wherein the second camera is adapted to acquire an image of the object.” *See supra* 3. *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[5] The handheld device of claim 1 wherein the second camera is adapted to acquire a video of the object.	MERL discloses “[t]he handheld device of claim 1 wherein the second camera is adapted to acquire a video of the object.” *See supra* 3. *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.

’924 Patent/Claim	MERL
[6] The handheld device of claim 1 wherein the computer is operable to determine a gesture based on at least one of the first camera output and the second camera output.	MERL discloses “[t]he handheld device of claim 1 wherein the computer is operable to determine a gesture based on at least one of the first camera output and the second camera output.” • Applications could include computer-controlled games or machines, or a more natural interface to the computer itself. Rather than pressing buttons, players could in a computer game pantomime actions or gestures, which the computer would recognize. CAD designers might use their hands to manipulate objects in the computer. People might use hand gestures to give commands to machines or appliances—a potential benefit to surgeons, soldiers, or disabled patients. The vision-based interactions could make the machine interaction more enjoyable or engaging, or perhaps safer. Computer Vision for Interactive Computer Graphics, p. 42 • If the camera views a hand on a uniform background, this method can distinguish hand positions and simple pointing gestures, as shown in Figure 1a. . . The robot followed the direction in which the hand was pointing; tilting the hand perpendicular to the camera caused the robot to stop. Computer Vision for Interactive Computer Graphics, p. 43. • If the camera views a hand on a uniform background, this method can distinguish hand positions and simple pointing gestures, as shown in Figure 1a. We implemented this to control the motion of the toy robot in Figure 1b. The robot followed the direction in which the hand was pointing; tilting the hand perpendicular to the camera caused the robot to stop. Computer Vision for Interactive Computer Graphics, p. 43. • Users can exploit the immediate visual feedback of the graphical display to change their gesture, if necessary, to achieve the desired effect. Computer Vision for Interactive Computer Graphics, p. 42.

’924 Patent/Claim	MERL
	• We wanted users to control the sprite by simple motions or pointing gestures. We had a user position his hand close to the camera so that his hand became a large object in the camera’s field of view. Computer Vision for Interactive Computer Graphics, p. 44. • Clearly, this throws out information, and some distinct images will be confused by their orientation histograms. In practice, however, you can easily choose a set of training gestures with substantially different orientation histograms from each other (such as Figure 5). Computer Vision for Interactive Computer Graphics, p. 46. • We first trained the system on hand signals for the commands up, down, left, right, and stop, by having the user show an example of each gesture. After training the computer, the user can use those commands to move around a crane under hand-gesture control. A graphical display of the closeness of each hand signal to the five trained categories gives the user feedback for implementing consistent gestures and helps to debug any miscategorizations. Computer Vision for Interactive Computer Graphics, p. 47. • We used the same recognition engine in an interactive game of rock, scissors, paper (Figure 6). A computer graphic “robot hand” plays the game against the user. The robot hand indicates when the user should make the gesture, allowing a simple open loop capture of the video gesture. Computer Vision for Interactive Computer Graphics, p. 46-47. • Often a person’s motion signals the important interface information to the computer. Computer vision methods to analyze “optical flow” can be used to sense movements or gestures. We applied motion analysis to control the Sega Saturn game, Decathlete (see Figure 8). The game involves the Olympic events of the decathlon (see Figure 9). The conventional game interface suffers from the limitations of the handheld control—to make the game athlete run faster, the player must press a

’924 Patent/Claim	MERL
	key faster and faster. We sought to let the user pantomime stationary versions of the athletic events in front of the artificial retina module by running or jumping in place. We hoped this would add an extra dimension to the game and make it more engaging. Computer Vision for Interactive Computer Graphics, p. 48-49. • We addressed both these design constraints by exploiting the television screen’s ability to provide graphical feedback.9 Our interface design is simple (see Figure 12). To turn on the television, the user holds up his hand. Then a graphical hand icon appears on the television screen, along with graphical sliders and buttons for television adjustments. The hand icon tracks the motions of the user’s hand (see Figure 13). The user adjusts the various television controls by moving the hand icon on top of the onscreen controls. The graphical displays and position feedback allows a rich interaction using only simple actions from the user. Computer Vision for Interactive Computer Graphics, p. 51.  Computer Vision for Interactive Computer Graphics, Fig. 6

’924 Patent/Claim	MERL
	 Computer Vision for Interactive Computer Graphics, Fig. 9. • We study how a viewer can control a television set remotely by hand gestures. Television Control by Hand Gestures, p. 3 of 7 [pdf]. • The open hand used for the trigger gesture and hand tracking is relatively straightforward to detect and track, even in a complicated scene. We use a normalized correlation method. Television Control by Hand Gestures, p. 4 of 7 [pdf].

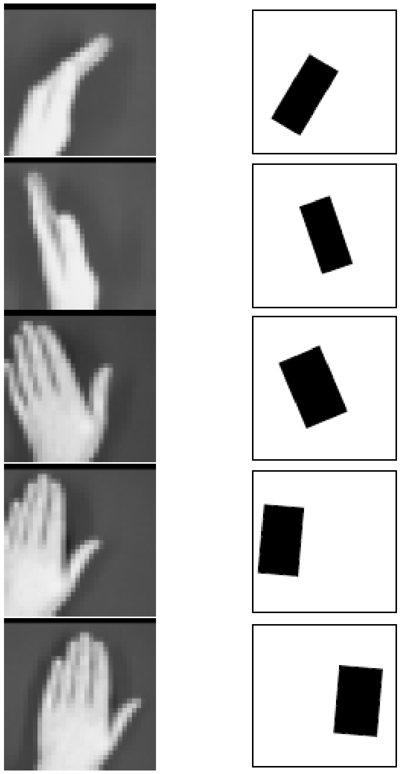


Figure 2: 32x32 input images of user's hand, and the equivalent rectangle having the same first and second order moments as those of the image. X-Y position, orientation, and projected width is measured from the rectangle. (Projected height is also measured, but with the hand extending off the picture as shown here, height is redundant with the vertical position of the center of mass).

’924 Patent/Claim	MERL
	Computer Vision for Computer Games, Fig. 2 on p. 4 of 8 [pdf], see also Figs. 3, 4, 6, 7 and 8. • Our system has two real-time demonstrations of gesture classification: control of the computer graphic crane of Fig. 4, and the game of “scissors/paper/stone", where the computer analyzes the user's hand gesture to decide the winner of each round. Orientation Histograms for Hand Gesture Recognition, p. 8 of 9 [pdf]. *See* source code appendix for U.S. Patent No. 5,454,043 and 5,594,469. *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[7] The handheld device of claim 1 wherein the computer is operable to determine a facial expression based on at least one of the first camera output and the second camera output.	MERL discloses “[t]he handheld device of claim 1 wherein the computer is operable to determine a facial expression based on at least one of the first camera output and the second camera output.” To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[8] The handheld device of claim 1 wherein the computer is adapted to determine at least	MERL discloses “[t]he handheld device of claim 1 wherein the computer is adapted to determine at least one of the position and the orientation of the object based on the second camera output.”

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

’924 Patent/Claim	MERL
one of the position and the orientation of the object based on the second camera output.	*See supra* 6. *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[9] The handheld device of claim 6 wherein the gesture is performed by a person other than the user of the handheld device.	MERL discloses “[t]he handheld device of claim 6 wherein the gesture is performed by a person other than the user of the handheld device.” *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[10] The handheld device of claim 1 wherein the computer is adapted to recognize the object based on the second camera output.	MERL discloses “[t]he handheld device of claim 1 wherein the computer is adapted to recognize the object based on the second camera output.” To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions. *See also* Video Clip of MERL, MERL00001.

’924 Patent/Claim	MERL
[12] The handheld device of claim 1 wherein the computer is adapted to determine a reference frame of the object.	MERL discloses “[t]he handheld device of claim 1 wherein the computer is adapted to determine a reference frame of the object.” • To control the sprite’s movement, we first calculated a motion energy image using the absolute value of the difference between successive video frames (see Figure 3). Computer Vision for Interactive Computer Graphics, p. 44. *See also* Video Clip of MERL, MERL00001. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[14] The handheld device of claim 1 wherein the computer is adapted to transmit information over an internet connection.	MERL discloses “[t]he handheld device of claim 1 wherein the computer is adapted to transmit information over an internet connection.” To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.

NOTE: Defendants apply the prior art in light Defendants' current understanding of the asserted claims and Plaintiff's apparent construction of those claims, as reflected in its Infringement Contentions and claim construction disclosures. Defendants' prior art invalidity contentions may reflect alternative positions as to claim construction and scope and do not represent any admissions or agreement by Defendants as to the construction meaning, scope, definiteness, function, structure, written description support for, or enablement of any claim contained herein. Defendants' contentions herein are not, and should in no way be seen as, any admission that Defendants' accused technology meets any limitations of the claims.

Exhibit A3

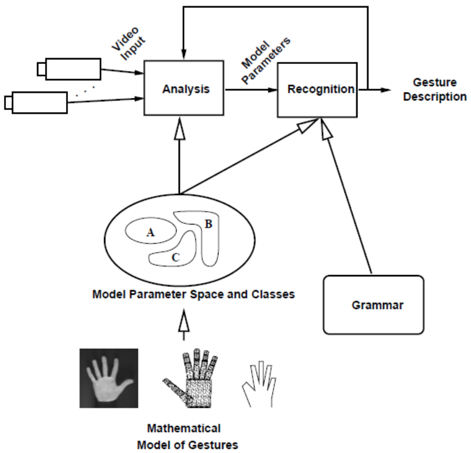
MDScope from the University of Illinois at Urbana-Champaign ("MDScope")
vs.
Claims of Asserted U.S. Patent Nos. 8,194,924 ("'924 Patent")

Formatted: Space After: 0 pt

'924 Patent/Claim	MDScope
'924 Patent	
[1.Preamble] A handheld device comprising:	To the extent the preamble is construed as limiting, MDScope discloses "[a] handheld device comprising:" • To handle this burden, the OAA facilitates distributed computing, in which different agents can exist on different computer platforms, ranging from workstations to hand-held personal assistants. One implementation of this architecture has been used in QuickSet, a multimodal interface for military simulation [83], which uses speech, handwriting, and pen gestures. Toward Multimodal Human–Computer Interface, p. 864. • QuickSet [83], [85] is a multimodal interface for control of military simulations using hand-held PDA's. It incorporates voice and pen gestures as the modes of interaction. This interface belongs to the class of decision-level fusers. It follows the OAA [82] with ten primary agents connected through a central facilitator.

’924 Patent/Claim	MDScope
	Toward Multimodal Human–Computer Interface, p. 865. • In particular, a large-screen projectors capable of displaying stereo images, coupled with hand-held spatial tracking devices conveying position and orientation for graphical object manipulation, offers an excellent collaborative environment for the study of molecular systems, where several researchers can simultaneously view and manipulate three-dimensional representations of biopolymer structures. MDScope- a Visual Computing Environment for Structural Biology, p. 113. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[1.A]: a housing;	MDScope discloses “a housing[.]”

Formatted

<table>
<tr><th>’924 Patent/Claim</th><th>MDScope</th></tr>
<tr><td></td><td>


Dynamic Bayesian Networks for Information Fusion with Applications to Human Computer Interfaces, Fig. 7.1

- The hand gestures are detected through a pair of strategically positioned cameras and interpreted using a set of computer vision techniques that we term automatic gesture recognition (AGR). Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 964.

See generally Speech-Gesture Interface, BECKMAN00000735; Molecular Dynamics Studies of the Protein, BECKMAN00000497 – 00000521; Simplified Expression of Message-Driven Programs, BECKMAN00000198 – 00000362; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012.
</td></tr>
</table>

<table>
<tr><th>’924 Patent/Claim</th><th>MDScope</th></tr>
<tr><td></td><td>To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.</td></tr>
<tr><td>[1.B]: a computer within the housing;</td><td>MDScope discloses “a computer within the housing[.]”

See supra 1.Preamble.

• 3) Visual Sensing: A video camera, together with a set of techniques for processing and interpreting the image sequence, can make it possible to incorporate a variety of human-action modalities into HCI.

Toward Multimodal Human–Computer Interface, p. 858.

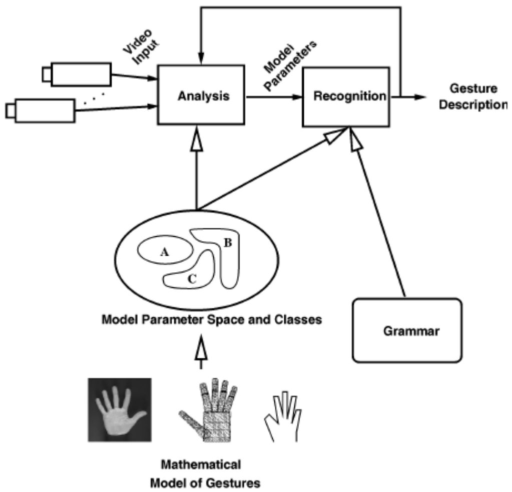
• For example, with the help of specially designed cameras and lighting, eye movements can be tracked at greater than 250 Hz and can be potentially used for controlling a display, either directly or indirectly, by designing multiresolution displays [31], [32].

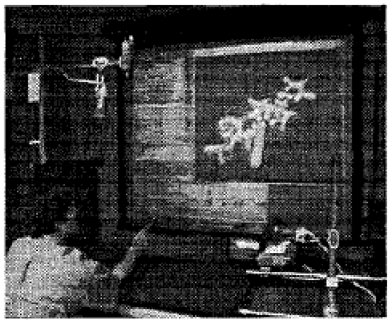
Toward Multimodal Human–Computer Interface, p. 858.

• It can occur, for example, when one or more cameras are used to capture visual information on one object.

Toward Multimodal Human–Computer Interface, p. 859.

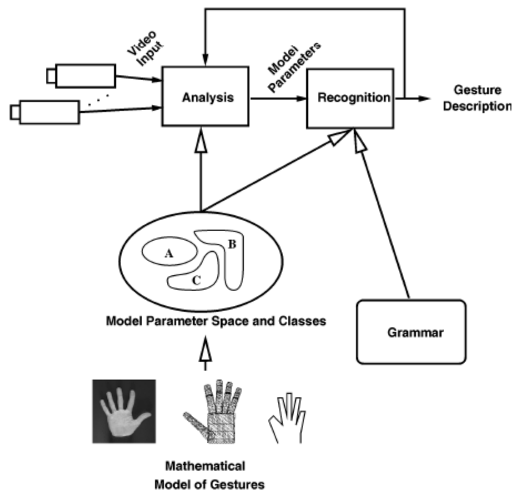
• The hand gestures are detected through a pair of strategically positioned cameras and interpreted using a set of computer-vision techniques that we term AGR. These computer-vision algorithms are able to extract the user hand from the background, extract positions of the fingers, and distinguish a meaningful gesture from unintentional hand movements using the context. The context of a particular virtual environment is used to place the necessary constraints to make the</td></tr>
</table>

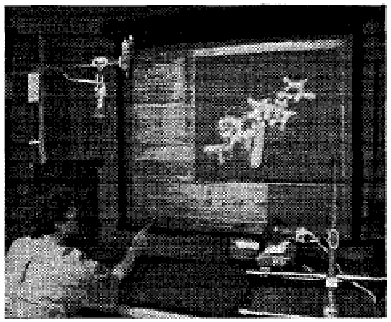
’924 Patent/Claim	MDScope
	analysis robust and to develop a command language that attempts optimally to combine speech and gesture inputs. Toward Multimodal Human–Computer Interface, p. 864. • The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images. Toward Multimodal Human–Computer Interface, p. 865.  Fig. 1. Vision-based gesture interpretation system. Visual images of gesturers are acquired by one or more video cameras. They are processed in the analysis stage where the gesture model parameters are estimated. Using the estimated parameters and some higher level knowledge, the observed gestures are inferred in the recognition stage.

’924 Patent/Claim	MDScope
	Visual Interpretation of Hand Gestures for Human-Computer Interaction: A Review, p. 678; Dynamic Bayesian Networks for Information Fusion with Applications to Human Computer Interfaces, Fig. 7.1. • The hand gestures are detected through a pair of strategically positioned cameras and interpreted using a set of computer vision techniques that we term automatic gesture recognition (AGR). Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 964.  Figure 2: *The experimental setup with with two cameras used for gesture recognition.* Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, Fig. 2. • The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images. The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images.

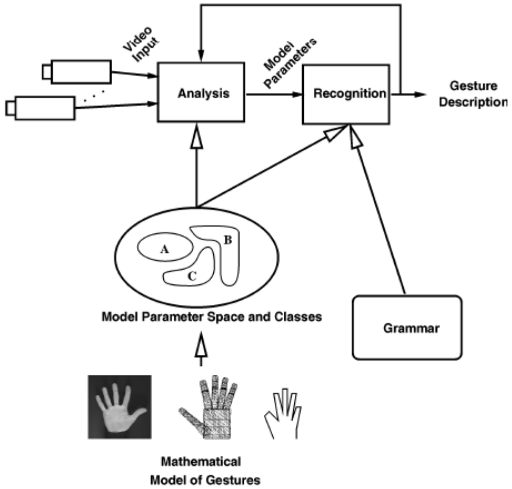
’924 Patent/Claim	MDScope
	Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 967. *See generally* Speech-Gesture Interface, BECKMAN00000735; Molecular Dynamics Studies of the Protein, BECKMAN00000497 – 00000521; Simplified Expression of Message-Driven Programs, BECKMAN00000198 – 00000362; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[1.C] a first camera oriented to view a user of the handheld device and having a first camera output; and	MDScope discloses “a first camera oriented to view a user of the handheld device and having a first camera output[.]” • For example, with the help of specially designed cameras and lighting, eye movements can be tracked at greater than 250 Hz and can be potentially used for controlling a display, either directly or indirectly, by designing multiresolution displays [31], [32]. Toward Multimodal Human–Computer Interface, p. 858.  Figure 1: Researchers of the Theoretical Biophysics group at the University of Illinois and the Beckman Institute utilizing a stereo projection facility with MDScope software, discussing the structure of a protein-DNA complex. (Photo courtesy of Rich Saal of the Illinois State Journal-Register, Springfield, Illinois.) MDScope- a Visual Computing Environment for Structural Biology, Fig. 1.

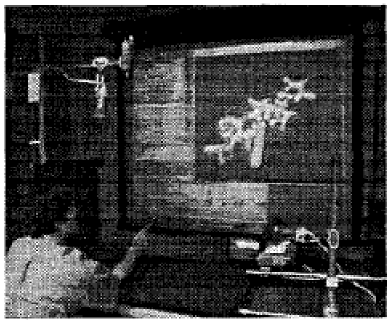
’924 Patent/Claim	MDScope
	• The major drawback of color-based localization techniques is the variability of the skin color footprint in different lighting conditions. Visual Interpretation of Hand Gestures for Human-Computer Interaction: A Review, p. 683. • In addition to the uniformly black background, there is a lighting arrangement that shines red light on the hand without distracting the user from the main 3D display. Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 965. • *3) Visual Sensing:* A video camera, together with a set of techniques for processing and interpreting the image sequence, can make it possible to incorporate a variety of human-action modalities into HCI. Toward Multimodal Human–Computer Interface, p. 858. • For example, with the help of specially designed cameras and lighting, eye movements can be tracked at greater than 250 Hz and can be potentially used for controlling a display, either directly or indirectly, by designing multiresolution displays [31], [32]. Toward Multimodal Human–Computer Interface, p. 858. • It can occur, for example, when one or more cameras are used to capture visual information on one object. Toward Multimodal Human–Computer Interface, p. 859. • The hand gestures are detected through a pair of strategically positioned cameras and interpreted using a set of computer-vision techniques that we term AGR. These computer-vision algorithms are able to extract the user hand from the background, extract positions of the fingers, and

’924 Patent/Claim	MDScope
	distinguish a meaningful gesture from unintentional hand movements using the context. The context of a particular virtual environment is used to place the necessary constraints to make the analysis robust and to develop a command language that attempts optimally to combine speech and gesture inputs. Toward Multimodal Human–Computer Interface, p. 864. • The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images. Toward Multimodal Human–Computer Interface, p. 865.  Fig. 1. Vision-based gesture interpretation system. Visual images of gesturers are acquired by one or more video cameras. They are processed in the analysis stage where the gesture model parameters are estimated. Using the estimated parameters and some higher level knowledge, the observed gestures are inferred in the recognition stage.

’924 Patent/Claim	MDScope
	Visual Interpretation of Hand Gestures for Human-Computer Interaction: A Review, p. 678; Dynamic Bayesian Networks for Information Fusion with Applications to Human Computer Interfaces, Fig. 7.1. • The hand gestures are detected through a pair of strategically positioned cameras and interpreted using a set of computer vision techniques that we term automatic gesture recognition (AGR). Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 964.  Figure 2: *The experimental setup with with two cameras used for gesture recognition.* Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, Fig. 2. • The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images. The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images.

’924 Patent/Claim	MDScope
	Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 967. *See generally* Speech-Gesture Interface, BECKMAN00000732 – 00000740; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012; Molecular Dynamics Studies of the Protein, BECKMAN00000497 – 00000521; Simplified Expression of Message-Driven Programs, BECKMAN00000198 – 00000362. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[1.D] a second camera oriented to view an object other than the user of the device and having a second camera output, wherein the first and second cameras include non-overlapping fields of view, and wherein the computer is adapted to perform a control function of the handheld device based on at least one of the first camera output and the second camera output.	MDScope discloses “a second camera oriented to view an object other than the user of the device and having a second camera output, wherein the first and second cameras include non-overlapping fields of view, and wherein the computer is adapted to perform a control function of the handheld device based on at least one of the first camera output and the second camera output.” • It can occur, for example, when one or more cameras are used to capture visual information on one object. Toward Multimodal Human–Computer Interface, p. 859. • The hand gestures are detected through a pair of strategically positioned cameras and interpreted using a set of computer-vision techniques that we term AGR. These computer-vision algorithms are able to extract the user hand from the background, extract positions of the fingers, and distinguish a meaningful gesture from unintentional hand movements using the context. The context of a particular virtual environment is used to place the necessary constraints to make the analysis robust and to develop a command language that attempts optimally to combine speech and gesture inputs. Toward Multimodal Human–Computer Interface, p. 864.

’924 Patent/Claim	MDScope
	• The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images. Toward Multimodal Human–Computer Interface, p. 865.  Fig. 1. Vision-based gesture interpretation system. Visual images of gesturers are acquired by one or more video cameras. They are processed in the analysis stage where the gesture model parameters are estimated. Using the estimated parameters and some higher level knowledge, the observed gestures are inferred in the recognition stage. Visual Interpretation of Hand Gestures for Human-Computer Interaction: A Review, p. 678; Dynamic Bayesian Networks for Information Fusion with Applications to Human Computer Interfaces, Fig. 7.1. • The hand gestures are detected through a pair of strategically positioned cameras and interpreted using a set of computer vision techniques that we term automatic gesture recognition (AGR).

’924 Patent/Claim	MDScope
	Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 964.  Figure 2: *The experimental setup with with two cameras used for gesture recognition.* Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, Fig. 2. • The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images. The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images. Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 967. *See generally* Speech-Gesture Interface, BECKMAN00000732 – 00000740; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012; Molecular Dynamics Studies of the Protein, BECKMAN00000497 – 00000521; Simplified Expression of Message-Driven Programs, BECKMAN00000198 – 00000362.

’924 Patent/Claim	MDScope
	To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[2] The handheld device of claim 1 wherein the handheld device comprises a mobile phone.	MDScope discloses “[t]he handheld device of claim 1 wherein the handheld device comprises a mobile phone.” To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[3] The handheld device of claim 1 wherein the first camera is adapted to acquire an image of at least a portion of the user.	MDScope discloses “[t]he handheld device of claim 1 wherein the first camera is adapted to acquire an image of at least a portion of the user.” *See supra* 1.C. *See generally* Speech-Gesture Interface, BECKMAN00000732 – 00000740; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.

’924 Patent/Claim	MDScope
[4] The handheld device of claim 1 wherein the second camera is adapted to acquire an image of the object.	MDScope discloses “[t]he handheld device of claim 1 wherein the second camera is adapted to acquire an image of the object.” *See supra* 1.D, 3. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[5] The handheld device of claim 1 wherein the second camera is adapted to acquire a video of the object.	MDScope discloses “[t]he handheld device of claim 1 wherein the second camera is adapted to acquire a video of the object.” *See supra* 1.D, 3. Our implementation produced a tracking rate of about **4** frames per second, mainly limited by the inability of the digitization hardware to properly handle multiple video signals. Special purpose hardware can easily improve the performance. However, even with the low sampling rate, the users can achieve a reasonable control of the display. Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 967. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[6] The handheld device of claim 1 wherein the computer is operable to determine a gesture based on at least one of the first camera output and the second camera output.	MDScope discloses “[t]he handheld device of claim 1 wherein the computer is operable to determine a gesture based on at least one of the first camera output and the second camera output.” *See supra* 1.B, 1.C.

’924 Patent/Claim	MDScope
	See generally Speech-Gesture Interface, BECKMAN00000732 – 00000740; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[7] The handheld device of claim 1 wherein the computer is operable to determine a facial expression based on at least one of the first camera output and the second camera output.	MDScope discloses “[t]he handheld device of claim 1 wherein the computer is operable to determine a facial expression based on at least one of the first camera output and the second camera output.” • Thus, eye movements can be considered a potential action modality for HCI. The facial expression and body motion, if interpreted appropriately, can help in HCI. Toward Multimodal Human–Computer Interface, p. 855. • The grammar could reflect not only the internal syntax of gestural commands but also the possibility of interaction of gestures with other communication modes like speech, gaze, or facial expressions. Visual Interpretation of Hand Gestures for Human-Computer Interaction: A Review, p. 679. *See generally* Speech-Gesture Interface, BECKMAN00000732 – 00000740; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders

’924 Patent/Claim	MDScope
	the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[8] The handheld device of claim 1 wherein the computer is adapted to determine at least one of the position and the orientation of the object based on the second camera output.	MDScope discloses “[t]he handheld device of claim 1 wherein the computer is adapted to determine at least one of the position and the orientation of the object based on the second camera output.” *See supra* 1.D, 6. *See generally* Speech-Gesture Interface, BECKMAN00000732 – 00000740; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012; Molecular Dynamics Studies of the Protein, BECKMAN00000497 – 00000521; Simplified Expression of Message-Driven Programs, BECKMAN00000198 – 00000362. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[9] The handheld device of claim 6 wherein the gesture is performed by a person other than the user of the handheld device.	MDScope discloses “[t]he handheld device of claim 6 wherein the gesture is performed by a person other than the user of the handheld device.” *See generally* Speech-Gesture Interface, BECKMAN00000732 – 00000740; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012; Molecular Dynamics Studies of the Protein, BECKMAN00000497 – 00000521; Simplified Expression of Message-Driven Programs, BECKMAN00000198 – 00000362. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders

Formatted: Font: Not Italic

’924 Patent/Claim	MDScope
	the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[10] The handheld device of claim 1 wherein the computer is adapted to recognize the object based on the second camera output.	MDScope discloses “[t]he handheld device of claim 1 wherein the computer is adapted to recognize the object based on the second camera output.” *See supra* 1.D. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[12] The handheld device of claim 1 wherein the computer is adapted to determine a reference frame of the object.	MDScope discloses “[t]he handheld device of claim 1 wherein the computer is adapted to determine a reference frame of the object.” • *3) Visual Sensing:* A video camera, together with a set of techniques for processing and interpreting the image sequence, can make it possible to incorporate a variety of human-action modalities into HCI. Toward Multimodal Human–Computer Interface, p. 858. • The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images. Toward Multimodal Human–Computer Interface, p. 865. • The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images. The gesture recognition is done by analyzing the sequence of images from a pair of cameras positioned such that they facilitate robust analysis of the hand images.

’924 Patent/Claim	MDScope
	Speech/Gesture Interface to a Visual Computing Environment for Molecular Biologists, p. 967. *See generally* Speech-Gesture Interface, BECKMAN00000732 – 00000740; Dynamic Bayesian Networks, BECKMAN00000019 – 00000159; A Visual Computing Environment, BECKMAN00000003 – 00000012; Molecular Dynamics Studies of the Protein, BECKMAN00000497 – 00000521; Simplified Expression of Message-Driven Programs, BECKMAN00000198 – 00000362. To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.
[14] The handheld device of claim 1 wherein the computer is adapted to transmit information over an internet connection.	MDScope discloses “[t]he handheld device of claim 1 wherein the computer is adapted to transmit information over an internet connection.” To the extent this reference does not expressly disclose this limitation, it inherently discloses the limitation. To the extent the reference does not expressly or inherently disclose the limitation, it renders the limitation obvious in light of the reference by itself or in combination with other references, as described in Defendants’ invalidity contentions.